

rates of HNO_3 , one can speculate that the seasonal dependence of Λ for this substance is probably smaller than that for SO_2 (and its overall magnitude is larger). Similarly, because of the apparently high reactivity of HNO_3 with all types of surfaces, it would seem reasonable to assume that the total resistance to mass transport is approximately equal to the aerodynamic resistance (i.e., $r_s \ll r_a$ in Equation 11), and to use values calculated from micrometeorological theories (see, for example, Table 1 in Garland, 1978). This leads us to expect fairly small seasonal variations of the deposition velocity for HNO_3 , probably smaller than those for SO_2 .

Nitric acid can be formed by homogeneous reaction pathways, mainly by reaction with hydroxyl radicals, or in the droplet phase (Orel and Seinfeld, 1977; Middleton and Kiang, 1979). Homogeneous processes are relatively well-understood compared to the heterogeneous ones, and are probably more important during the daytime in summer, and display a similar seasonal dependence to those for SO_2 oxidation (see Section 3.1 and also Bottenheim and Strausz, 1980). Nitrogen oxides transformation rates of over 20% h^{-1} have been observed in urban plumes, most likely due to homogeneous reactions (Spicer, 1979), and power plant plume studies have also yielded nitrate formation rates several-fold those of sulfates (e.g., Forrest et al., 1980), which are consistent with a homogeneous reaction mechanism. Heterogeneous processes may be an important source of nitrates at night and in the winter (Middleton and Kiang, 1979), but too little reliable information is available on the chemistry involved to speculate on seasonal trends in the HNO_3 formation rate.

Particulate nitrates are probably formed by heterogeneous processes, and consist of a number of salts, with ammonium nitrate being one of the most important (Orel and Seinfeld, 1977; Middleton and Kiang, 1979). During the summertime, particulate nitrate concentrations are apparently relatively small compared to those of vapour phase nitric acid (e.g., see Spicer, 1979; Spicer et al., 1980; Tang, 1980). During the winter, especially at northern latitudes, the reverse could be true, but due to difficulties involved in sampling HNO_3 and particulate nitrates separately, insufficient data are available to answer this question. Little can be said about the wet and dry deposition of nitrates and its seasonal dependence. In the